

Proposed Approach
BDCP Interim and Near-Term Actions
Draft 4.27.10

The Bay/Delta Conservation Plan is faced with great uncertainty in the near term as to how best move forward to improve the status of native species dependent on the Delta while simultaneously improving water supplies for users of water conveyed through the Delta. What seems clear is that taking no new actions, other than following the current management approach of reducing pumping levels from the Delta combined with relatively limited habitat improvement actions, is a recipe for stagnation and potential collapse of both ecosystem services and water supply and the economic and social benefits that derive from both. Therefore, to move conservation of Delta resources forward, the BDCP commits to this action plan that implements a series of conservation measures fully integrated with and guided by monitoring, science, and adaptive management.

BDCP interim and near-term actions can be used to guide the transition from the existing biological opinions to new biological opinions and the expected long-term project operations. The approach is premised on initial operations conducted within the flexibility of the existing biological opinions, recognizing that they may change over time with new scientific information and review, as well as be supplemented by ongoing implementation measures to improve habitat and reduce other stressors.

CVP/SWP operations are conducted in compliance with existing OCAP biological opinions issued by US Fish and Wildlife Service and National Marine Fisheries Service and other regulatory programs. These biological opinions are currently subject to ongoing litigation which may result in another reinitiation or alteration of the current biological opinions. The National Research Council has produced a scientific assessment of these biological opinions, and the report may affect future management approaches to the Delta. Also, the BDCP process is undertaking an effects analysis of the conservation measures under consideration for implementation as a part of refining the proposed action prior to release of a draft HCP/NCCP for public review. This analysis is intended to evaluate the potential overall effects of the BDCP, including implementation over time of operational changes and improvements, habitat restoration, and reduction of other stressors widely recognized as adversely affecting species using the delta.

Given the various reviews under way, protective measures may change prior to approval of the BDCP. A BDCP interim and near term package designed to work initially within the flexibility of the existing biological opinions, while complementing the actions prescribed in the BOs with additional measures that address habitat and other stressors, and advancing our understanding of covered fishes stressors, is proposed as an initial course of action. Once the BDCP is approved, new biological opinions will be written that are expected to more fully integrate a multi-pronged approach to conservation during the near term period that incorporates contemporaneous improvements in scientific knowledge, ecological processes and water supplies. These goals are illustrated in Figures 1 and 2. As actions are satisfactorily completed to improve understanding and implement conservation measures as illustrated in Figure 1, water supply reliability would improve in a step wise fashion as illustrated in Figure 2. This course of action is proposed recognizing that the actions recommended herein may change based on additional information from science reviews, studies, improved status of covered species, input through the NEPA/CEQA process, or new biological information not previously considered.

Therefore, this outline suggests a three-tier approach to implementing interim and near-term actions. The tiers are:

- 1) **Work within the areas of operational flexibility of the existing and/or revised biological opinions.** The areas of flexibility found within the FWS biological opinion RPA are: 1) implementation of Old and Middle River (OMR) flow restrictions; and 2) implementation of the fall X2 experiment. The areas of flexibility within the NMFS BO are: 1) implementation of OMR flow restrictions; and 2) possibly later after science review, implementation of the San Joaquin export to inflow to export ratio from April 1 through May 31.
- 2) **Implement habitat restoration and complementary actions to improve status of covered fish species.** Delta smelt habitat restoration is required by the FWS BO. Complementary actions can include: 1) Implementation of the Two Gates Experimental Program; 2) targeted predator control studies and implementation; 3) targeted screening of non-CVP/SWP diversions; and 4) screening of Clifton Court Forebay.
- 3) **Continue to Investigate Covered Species Stressors.** Areas of particular concern in the interim and near term period that deserve additional investigation include: 1) continued evaluation of the OMR relationship to entrainment of covered fish; 2) continued evaluation of the underlying mechanisms of the fall X2 to delta smelt survival; 3) continued evaluation of the contribution of environmental contaminants to covered species declines and the underlying sources of contaminants of concern; and 4) continued evaluation of San Joaquin River salmonid outmigrant survival and methods to improve survival.

Premised on the above approach, below is a proposed interim and near-term package of actions, laying out very specific science, habitat and other stress measures, and what outcomes we think will result from those actions. Outcomes may be expressed from actions individually or collectively, and may be additional knowledge as well as hypothetical biological benefits. The intent is to develop additional action plans and expected outcomes for each year from 2010 through 2014. (This would essentially lay out the early stages of the BDCP adaptive management program.)

YEAR: 2010

Science Actions (actions or analytical work to improve certainty of benefit or reduce uncertainty of impact); many of these are already underway or planned by Delta Science Program

1. **Steps to validate delta smelt behavioral model for evaluation and implementation of adult life stage management actions.**
 - a. Modify the turbidity algorithm, as described by John DeGeorge to the 2 Gates science review panel.
 - b. Update the SBM based on step (a) and run simulations to test the model.
 - c. Implement pilot study in winter 2009-2010 of delta smelt response to increasing turbidity and other hydrodynamic and water quality variables.(see Bennett and Burau. Physical Process Influencing Spawning Migrations of Delta Smelt. Dated 12.29.2009)
 - d. Using results of a-c above, further validate the SBM.
 - e. Present results in seminar or workshop for additional review.
 - f. Undertake a focused review and collaboration organized by Delta Science program that includes experts in fish behavior modeling
 - g. Evaluate how we can operate existing infrastructure more efficiently to provide same or better level of protection to delta smelt.
 - h. Establish capacity within the project agencies to implement SBM forecasting.

EXPECTED OUTCOME: If results support use of the SBM as a forecasting tool, then begin applying the model outputs to assist in decision-making purposes for use in 2011 water operations. (specify anticipated improvements in delta smelt and water supply based on this tool's application)

2. **Complete development of Potential Entrainment Index (PEI) to apply to implementing water management actions to minimize effects of project operations to larval and juvenile delta smelt.**

NOTE: DWR IS DRAFTING THIS SECTION.

EXPECTED OUTCOME: If results support use of the PEI, then use to support operations decision making in 2011. If results do not favor implementation of PEI, continue to evaluate other models or approaches that may improve management of entrainment of larvae and juvenile delta smelt.

3. **Complete report on Two Gates investigation and use results to guide further evaluation of structural and operational strategies to protect fish at different life stages until new conveyance facilities are complete. Link results of this investigation to more detailed analysis in winter 2010-2011.**

EXPECTED OUTCOME:

4. **Actions to evaluate causes of San Joaquin River salmon mortality and effectiveness of physical barriers such as the “bubble curtain” or predator control.**
 - a. Convene a Delta science advisory group (Delta Science Program already accomplished this planning as part of VAMP review in early 2010) to develop experimental design for 2010-11, looking at one or more of the below proposals:
 - i. Conduct a predation management study by making two releases of tagged salmon on the San Joaquin River, one with predator management, the second without predator management, and both conducted on the same reach separated in time.
 - ii. Conduct additional experiment with bubble curtain (in conjunction with VAMP?), with the following changes: i) increase the number of fish released (#?), ii) if high SJR flow year, test effect on predator vs. salmon movement; and iii) devise other methods to study predator role in salmon mortality.
 - iii. Conduct additional experiment with bubble curtain at Georgiana Slough.

EXPECTED OUTCOME: In November 2011, review these and any other studies conducted to confirm proportional causes of mortality due to flows, exports, predation and other adverse effects on Salmonid migration, consider whether such methods are equally or more effective in protecting migration, and if so, adjust actions as possible within the existing BO constraints.

5. **Analyze questions regarding effectiveness of fall X2 flows**
 - a. convene a panel of scientists as specified in Appendix B of the BO, to review and improve the habitat conceptual model and look at the following questions:
 - i. Is the “fall X2/smelt habitat relationship” statistically robust?
 - ii. Is the population of delta smelt limited by the volume of fall habitat of ascertain salinity?
 - iii. What components of delta smelt habitat other than outflow volume may be needed equally or more so for their protection?

EXPECTED OUTCOME: Effectiveness comparison between high fall outflows with habitat restoration and other stressor reduction options.

6. Assemble a Delta science review panel on smelt population estimation.

- a. Assess current status of smelt and other POD populations estimates
- b. Review relevance of current sampling technology and methodology.
- c. Identify experimental needs to develop delta smelt population estimate, including intensive surveys of smelt correlated to current FMWT and other sampling to related FMWT survey results to actual population

EXPECTED OUTCOME: Develop and begin to implement more detailed and site-specific sampling protocols for different locations in channel and subtidal areas (shallows vs. tidal marsh, vs. open channel, vs. turbid water, etc.)

7. Develop and apply comprehensive species life cycle models per recommendation of NRC panel review.

EXPECTED OUTCOME: Life cycle models for the covered fish species could be linked to hydrological and hydrodynamic models to 1) assist with prioritizing actions relative to benefits for distinct life history stages; and 2) integrate management of Delta water project operations designed to address actions for individual species and life stage benefits.

8. Convene a workgroup to develop a proposal for the BDCP science program (e.g. Jason's group). The workshop should:

- a. Clearly define role of BDCP science program. ie. Monitor and evaluate implementation of the conservation measures based on clear measurable metrics, support adaptive management decision making process, support continued research on key food web pathways, develop methods to prioritize implementation of conservation measures, etc.
- b. Define relationship to other ongoing Delta science and monitoring efforts, ie. Delta Science Program, IEP, etc. Support enhanced network capability with other science programs.

EXPECTED OUTCOME: A rigorous science program that oversees monitoring and research aspects of BDCP conservation measures and guides adaptive management decision making. Coordinates closely with all Delta monitoring and research programs.

Habitat Actions (actions to improve status of covered fish and contribute to recovery):

1. Take immediate steps to implement improvements on Yolo bypass that can improve fish passage, survival and growth rates

- a. Establish a workgroup to develop concept, design, perform environmental review and obtain permits for modification of Lisbon Weir to make more effective barrier to sturgeon stranding; use this effort as a pilot project for BDCP implementation to work through mitigation, funding, crediting and other implementation issues.
- b. Establish workgroup to identify and take next steps on Putah Creek realignment.

- c. Research to further analyze proportion of fish passing through bypass versus remaining in river (i.e., Jon Burau's work on "route selection probabilities". Adult and juvenile sturgeon and salmon telemetry to document 1) distribution as above and 2) pre-and post-project passage at Lisbon Weir, other structures in the Tule Canal/Toe Drain, Fremont Weir
- d. Establish workgroup to identify and take next steps on operable Fremont Weir notch: ground rules for management – how much acreage to be flooded in a non-spill year, steps needed to deal with farmer and Yolo Refuge concerns

EXPECTED OUTCOMES

2. Begin restoration of tidal marsh on Yolo Ranch

- a. Develop conceptual restoration plan alternatives for focused review conducted in cooperation with Delta Science program.
- b. Identify monitoring needs for implementation and guidance of future adaptive management.
- c. Follow up on results from Delta Science tidal marsh workshop and conduct additional research, monitoring and analysis of habitat quality and quantity on Liberty Island (this info should feed into fall X2 science effort); also need more information on Delta smelt access to Cache Slough

EXPECTED OUTCOMES: Metrics to include: turbidity, EC/salinity, temperature, pH, dissolved oxygen, vegetation cover by type, nutrients (ammonium, nitrate, and phosphate), zooplankton and benthic invertebrates, fish community including abundance of predators, native versus non-native numbers and biomass, and spatial and temporal distributions of key covered species. All metrics to compare before and after conditions on-site, as well as continued comparisons with other non-restored locations.

3. Initiate work to restore tidal marsh in South Roaring River Complex of Suisun Marsh

- a. List steps needed to carry this forward

EXPECTED OUTCOME?

4. Establish workgroup to identify and take next steps on Dutch Slough.

5. Establish workgroup to identify and take next steps on Prospect Island.

6. Initiate work on Lower Mokelumne/McCormach-Williamson

- a. Need more info

7. Assess feasibility of channel margin restoration on Sutter and Miner Sloughs to encourage salmon smolts to move into restored portions of Liberty/Cache area and away from reach of project operations (Jon Burau idea)

SUMMARY OF EXPECTED OUTCOMES OF ALL ACTIONS BY END OF 2010: Improved protection from entrainment of covered species with modest improvement in water supply (Figure 2).

YEAR: 2011

Science Actions

Other Stressors Actions (actions to improve status of covered fish and contribute to recovery):

1. (update this section with help from Frances based on comments from Cliff) Follow up on research needs identified in CalFed science workshops on ammonia impacts on ecosystem (need more specifics)

- a. Evaluate the relationships between changes in nutrient loadings, concentrations, and ratios to phytoplankton and zooplankton abundance and species composition. A cursory review of the historical data has found significant correlations between changes in nutrient ratios and trends to phytoplankton and zooplankton species composition and abundance.
- b. Determine to what extent the system has become heterotrophic; supporting a bacterial food chain instead of an algal food chain. Measure isotope uptake in water column samples from key stations on at least a seasonal basis to determine carbon uptake rates of bacteria versus algae.
- c. Inge Werner at UC-Davis observed higher toxicity when Delta smelt were exposed to dilutions of Sacramento Regional Wastewater Treatment Plant effluent samples than to an equivalent level of total ammonia from lab grade ammonium chloride. The Dugdale Laboratory at San Francisco State University also observed a greater effect in algal grow out experiments in effluent dilutions than in the equivalent ammonium concentration using lab grade ammonium chloride. Determine why the effluent has a greater effect than ammonium alone through a combination of analytical and biological Toxicity Identification Evaluation techniques.
- d. Swee Teh at UC-Davis conducted sensitivity tests with both *Eurytemora affinis* and *Pseudodiaptomu forbesi* and found that both species are among the most sensitive species to ammonia and copper. The Regional Water Quality Control Board is contracting with Swee Teh to conduct 30-day life cycle tests with *P. forbesi* exposed to lab grade ammonium chloride. Expand this evaluation to include 30-day life cycle tests with *P. forbesi* using Sacramento Regional Wastewater Treatment Plant effluent samples diluted to an equivalent concentration of total ammonia.
- e. Conduct additional toxicity testing with copepod species exposed to ambient samples from locations in the Delta where significant mortality was observed in 2008. If significant mortality is observed again, conduct analytical testing and modified Toxicity Identification Evaluations to try to determine cause of toxicity.
- f. Evaluate preserved Delta smelt for histopathological changes that could indicate sublethal or chronic effects.

EXPECTED OUTCOMES

1. Improve understanding of how nutrients, particularly those from wastewater treatment plant discharges, may be driving foodweb community composition and how those effects might cascade through the foodweb to fish species of concern.
 2. If the system is heterotrophic it could be an indication that the system is becoming eutrophic and nutrient controls are needed. The bacterial foodweb is not effectively transferred to fish productivity.
- 2. Review current information and convene workshop or seminars on role of pyrethroids in fishery recovery. Use this information to guide additional studies to determine how widespread are pyrethroids effects in Delta, determine how sensitive benthic invertebrates are to pyrethroids, and whether there is substantial toxicity to benthic invertebrates in lower Sacramento River and other parts of the Delta.**

2011: Habitat and Other Stressor Actions (actions to improve status of covered fish and

contribute to recovery):

- 1. Begin restoration of Yolo Ranch with goal of total restoration by ?.**
- 2. Begin restoration of Dutch Slough with a goal of total restoration by?**
- 3. Implement pilot actions within Yolo Bypass to improve anadromous fish passage.**
- 4. Carry forward San Joaquin River actions identified above deemed beneficial to reduce outmigrant mortality (eg. Bubble curtain, predator removal).**
- 5. Smelt refugium – add steps from federal workplan**
- 6. Ship channel DO project**
- 7. Clamp down on illegal sturgeon harvest – catch and release on upper Sacramento River; review RBDD sturgeon studies.**

EXPECTED OUTCOME IN Water supply: to be filled in with contractors' near-term reliability goals